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On Some Infusoria Found on the Cray-Fish.

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The observations recorded in this communication were made principally at Buffalo, N. Y. There are three species of the crustacean inhabiting the Niagara River, viz: *Cambarus diffinis*, *C. propinquus*, and *C. Bartonii*. In my search for true parasites of our crays I have often been amazed at the abundance of Infusoria making a home upon the exoskeleton, limbs, and within the gill-chambers. The majority belong to the Vorticellidæ, including species of *Vorticella*, *Epistylis*, *Carchesium*, *Zoothamnium*, and others. In May last these animals, particularly the females brooding their eggs, were literally covered by a whitish mucilaginous envelope consisting of infusorians in myriads belonging to the genera mentioned. It is not my purpose to dwell on such as these, found not only upon the cray, but which are equally at home on Mollusks and aquatic plants. On the other hand, there are two species of Infusoria apparently peculiar to the gill-cavities of the sweet-water lobster. At least I can find them nowhere else, although I have searched for them diligently. These require more extended consideration, and, in addition, an interesting species, thus far obtained only from the exoskeleton, will be described.

The first species (Figs. 1—6), of interest from the gills is a loricate peritrichous form, which differs so widely from any heretofore described, that I do not hesitate to present it as new. Since the attached lorica is stalked, erect, and without an operculum, it belongs to the genus *Cothurnia*. I think it must appear on examination of the mounted loricae, herewith presented, that it may appropriately be called *Cothurnia variabilis*, n. s. The lorica is about twice longer than broad. Seen from the side, it is strongly ventri-

cose and uniformly convex posteriorly. The neck is narrow, its width being less than half that of the carapace; the laterally compressed orifice is set very obliquely, sometimes quite vertically,



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

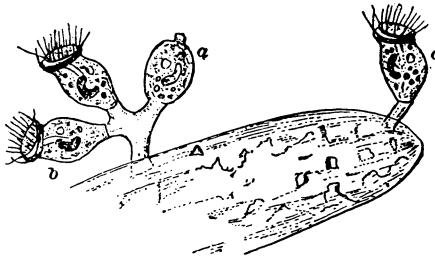


Fig. 7.



Fig. 8.

with the upper edge produced into a cusp and, with a tooth-like angle in the middle of either margin, (Fig. 1, b), the aperture is sometimes awry, turning the cusp to one side of the axis of the shell. The peduncle is short, not exceeding, as a rule, one-fourth the length

of the lorica; it is often less, and the shell apparently sessile. The animalcule is attached to the bottom of the sheath; the peristome is narrow and is protruded only a short distance beyond the edge of the aperture. The contents of the zooid's body are finely granular; the nucleus of the usual band-like pattern.

The animal is very timid, and very rarely ventures beyond its shield while under observation. I have seen hundreds, and watched individuals continuously for hours, witnessing the protrusion of the body in not more than two instances. The usual position assumed when removed from their natural condition is a close retreat to the shell, or reaching up so that the edge of the peristome is in the mouth of the case. In this position it suggests the youthful amusement of "hide-and-seek," for on the least motion of the instrument it instantly springs back to the bottom of the lorica, to slowly reach up again, apparently to survey the surroundings, and take advantage of favorable circumstances, but the provoking part is that it will so persistently continue to peep over the wall, and not venture out.

Many examples are met with which differ considerably in the characters of the loricae. For example, a large number have a spine, sometimes bilobed at apex, extending upward from the anterior protuberance of the shell, (Fig. 4, b). These are relatively shorter, as may be seen by an examination of the figure, than the type, with the aperture less irregular, and with the cusp at the upper end reduced to a mere point, (Fig. 4, a). On some crays I have found this variety to be the more common form. The study of several examples of the membrane from the inner surface of the branchiostegites, mounted in glycerine, and on which there are scores of the shells, indicates that the type form occurs on the long hairs covering the membrane, while the variety attaches to the membrane itself; and yet there are numerous exceptions. Again, there are forms between these, usually with the neck and aperture awry and the whole shell often one-sided—that is, in front view, one side flat and the other convex. This variety usually occurs on the gills, and appears to be an effort to accommodate, by a change of form, the loricae to crowded quarters.

There is another variety of special interest, which I will call *Emarginata*, (Fig. 5). Thus far it has been found principally on the

gills, where they often stand like a rank of soldiers along the lateral branches. It differs from the type in being relatively longer, less ventricose, and in having the narrow neck vertical, the aperture horizontal, the posterior edge of which is emarginate instead of being prolonged into a point, or spine. The tooth on the ventricose part of the shell is usually present. There is much variation in the size and proportions of the sheaths, in the length of the pedicle, and in other particulars. Had isolated examples of this variety and the type form alone come under examination, it would have been quite natural to have regarded them as distinct species, but the intermediate forms convince me that the modifications are of one species. The color of the lorica varies much; in the young ones it is colorless and highly transparent, in others it is yellowish, or even rust-brown. The light and dark shades occur equally abundant among all varieties, so that I can not see that relative age has to do with the variations. The length of the lorica of the chief form varies from .003 to .004 inch; of *emarginata*, from .003 to .004 inch.

I have found these infusorians abundant, particularly in early summer, in some cases so numerous as to render the gills brown. The burden, however, is removed by the molting of the cray. July 18th last, an old fish was taken just about ready to cast off its shell, the gills had already in part lost their former covering. Fragments of this cast skin under the microscope revealed numerous loricae, either empty or with the animals, in most cases, in a changed form. Their bodies were now pyriform, with a row of cilia encircling the basal third; they were either attached to the sheath or free, in the latter case they were turning and tumbling about their inclosure in a lively manner, occasionally stopping for a brief rest, then taking up their antics more energetically than before. I suspected what the end would be, and had the good fortune to see one make its way out of its prison and swim away a free infusorian. After watching for a long time its apparently ineffectual efforts to free itself it was seen to force its way through the neck, presenting one side at the aperture so that the ciliary band protruded. In this position it remained for some time vigorously lashing the water and gradually working its plastic body out until it finally broke away and swam rapidly about the field. It is obvious, from the large number undergoing this

transformation, that their changed conditions had given them warning that it was time to let go the old anchorage and catch on anew.

The Vorticellidæ multiply by longitudinal binary divisions. In accordance with the traditions of its family our *Cothurnia* thus increases, so that two individuals are often seen inhabiting the same lorica. One must ultimately leave the old home; when it does, it often establishes itself upon the outside of the same, so that chains of individuals of as many as five or six are often met with, (Figs. 2, 3.) The usual way is for the new structure to become attached to the back of the neck of the parent structure, so that the result scarcely appears to be accidental; it recalls the habit of *Pyxicola socialis*. In the excellent *Manual of the Infusoria*, by W. S. Kent, there is cited a case of a fatal epidemic among the fresh-water cray-fishes of Lombardy and Venetia in the year 1863, in which the dying crustaceans were completely infested with an infusorian, probably identical with *Cothurnia astaci*, its abnormal development on the branchial appendages apparently producing the death of the crustacean through asphyxia. The present species differs very widely from *astaci*, and certainly is not identical although it has a similar habitat. As previously stated *variabilis* is often sufficiently abundant to encumber the gills of its host and perhaps cause death; this I know, those lethargic crays from along shore early in spring are very badly infested. Of the other species of *Cothurnia* only *imberbis* has been found by me upon the cray-fish, then on the swimming feet.

The remaining species which inhabits the gill-cavity is an *Epistytis*, (Fig. 7). I am still in doubt concerning its identity, hence I shall only give a general account of it. It usually occurs in small colonies upon short, stout pedicles with the secondary branches very short. In favorable locations, however, the colonies are larger and the tree-like stalk much longer and more slender. The zooids, when contracted, are ovoid, or even globular, with a rather wide, snout-like projection in front. When they expand the bodies elongate, the lower third becoming somewhat attenuate; they are widest near the middle; below the peristome the body again contracts so as to form a neck-like groove. The bodies of the zooids are quite plastic, so they are

often unsymmetrical or move themselves from side to side on their rigid pedicles. The endoplosm contains many coarse granules; no rotation witnessed. The ciliary disk is considerably narrower than the peristome, and the edge next the vestibule is tilted up, reminding one of an *Opercularia*. The peristome is also set obliquely with the axis of the body. The cuticle under a high power proves to be transversely striate. The average length of the zooids is .0016, the width of the same .001. The species is abundant throughout the year. It is very sensitive, and can rarely be caught with its cilia expanded and in motion. When kept in the compressorium a few minutes the zooids withdraw the disks closely, contract their bodies, and nothing will induce them to expand again; when thus closely contracted a pellucid globule often exudes from the "snout." I am not prepared to say what it is, or what is its fate.

EPISTYLIS NIAGARE, N. S. —There occurs on the crayfish of the Niagara, and probably on other convenient supports, although not yet found elsewhere, an *Epistylis* which differs by well-marked characteristics from any described, and I propose to name it after the noble river in which it is so abundant. It fastens upon the antennæ and exoskeleton of the cray, forming whitish mucilaginous patches. The pedicle branches dichotomously, is smooth, attains one-tenth of an inch in length, and bears many zooids. So far the characters are closely those of *E. plicatilis* or *E. Anastatica*, both abundant in the same river. The zooids are elongate, more than three times as long as broad, slightly gibbous, much attenuated at the lower extremity. The body is constricted below the peristome border, which is thickened collar-like. The ciliary disk is continued above the peristome as a prominent boss-like granular body. The inclosure is fine granular; the cuticle smooth. The nucleus is flat, twisted, and placed transversely at the upper third of the body. When contracted the ovoid bodies have a snout-like projection which is strongly striate longitudinally. Length of body fully expanded .0064 of an inch, (Fig. 8). The zooids expand persistently and do not leave their stems when confined in a limited quantity of water. I have had them in a saucer of water until the *Saprolegnia* growing from the fragment to which they were attached enveloped them, but the zooids were still as active as ever.

In the construction of the body beneath the peristome border, and in the tumid, conical, ciliary disk, which wants the annulations at the base, however, the species resembles *E. balanorum*, but the longer pedicle, and large number of individuals in a colony, and the large zooids mark substantial differences. Besides, the body is slightly gibbous—not so in *E. balanorum*. The nucleus also differs; it differs from *E. umbilicata*, which has a similar ciliary disk, by entirely dissimilar shape and character of pedicle. It may be distinguished from *E. digitalis* by its smooth pedicle, being coarsely annulate in that species, smooth in this; also, by the characters of the peristome and ciliary disc. The last mentioned characters also separate it from *E. plicatilis* and *E. anastatica*.